FIG. 1

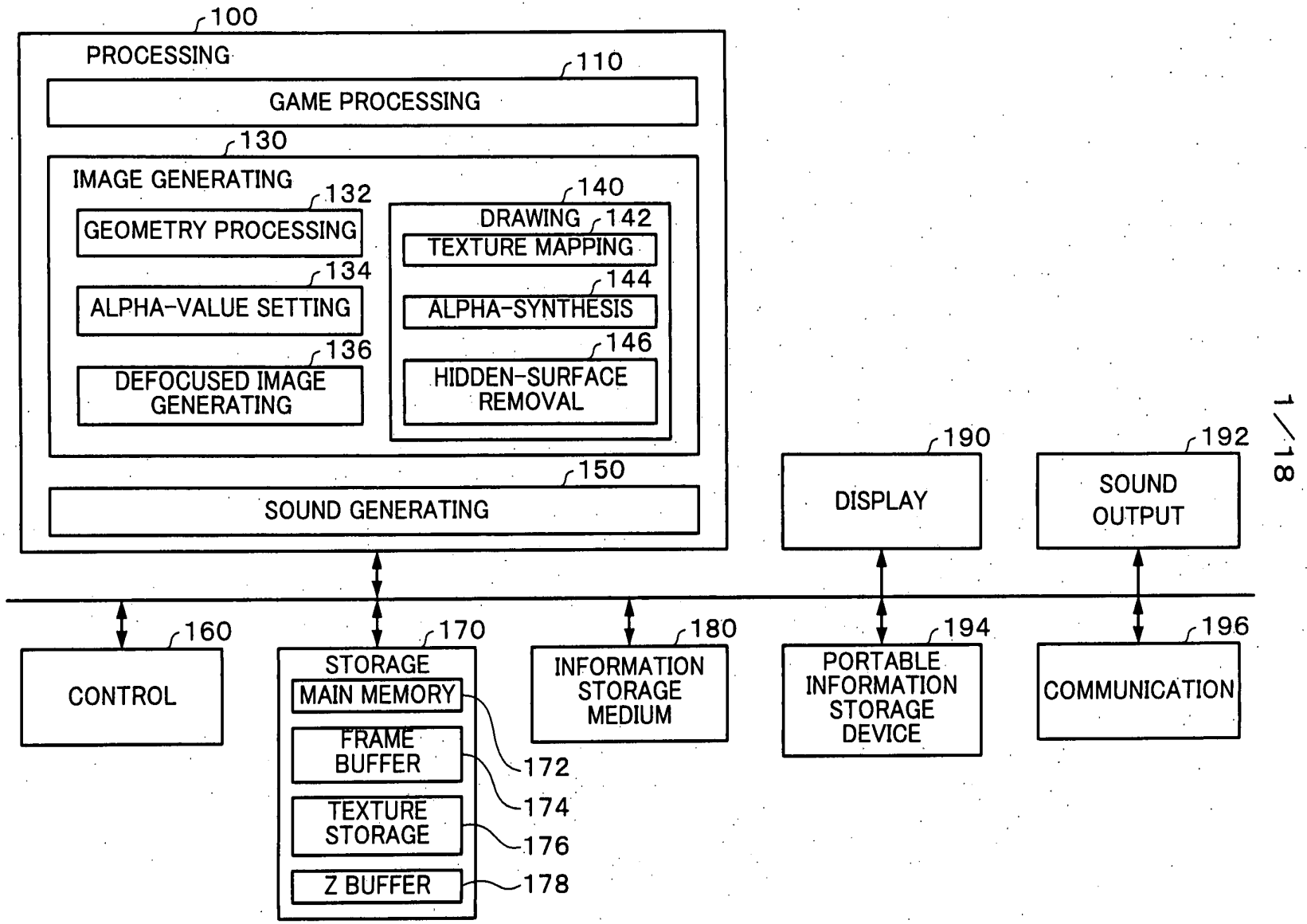

100
PROCESSING
110
GAME PROCESSING
130
IMAGE GENERATING
132
GEOMETRY PROCESSING
134
ALPHA-VALUE SETTING
136
DEFOCUSED IMAGE GENERATING
140
DRAWING
142
TEXTURE MAPPING
144
ALPHA-SYNTHESIS
146
HIDDEN-SURFACE REMOVAL
150
SOUND GENERATING
190
DISPLAY
192
SOUND OUTPUT
1
18
160
CONTROL
170
STORAGE
MAIN MEMORY
FRAME BUFFER
TEXTURE STORAGE
Z BUFFER
172
174
176
178
180
INFORMATION STORAGE MEDIUM
194
PORTABLE INFORMATION STORAGE DEVICE
196
COMMUNICATION

FIG. 2

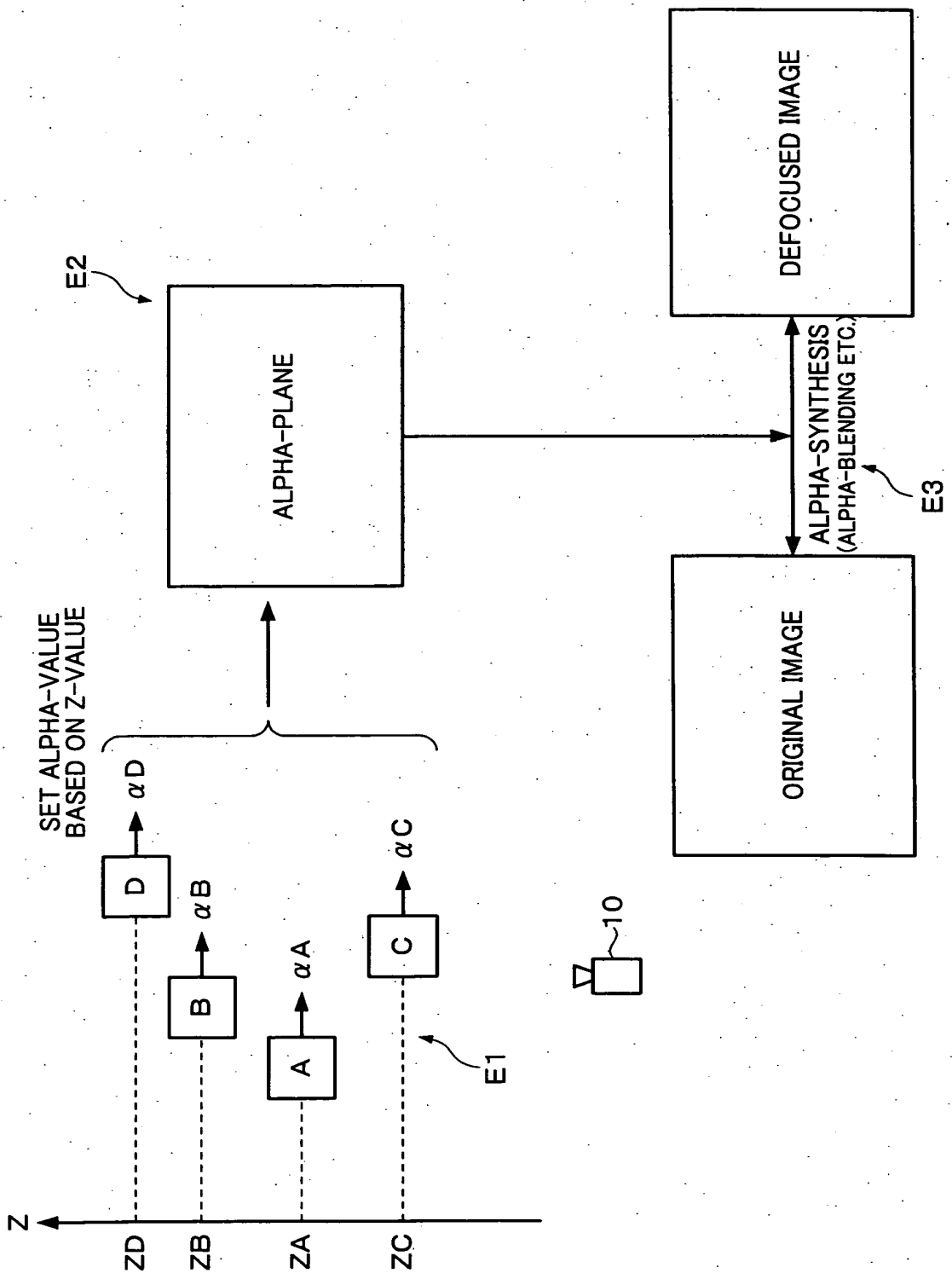

Z
ZD
ZB
ZA
ZC
D
B
A
C
αD
αB
αA
αC
E1
10
SET ALPHA-VALUE BASED ON Z-VALUE
E2
ALPHA-PLANE
DEFOCUSED IMAGE
ORIGINAL IMAGE
ALPHA-SYNTHESIS (ALPHA-BLENDING ETC.)
E3

FIG. 3A ORIGINAL IMAGE

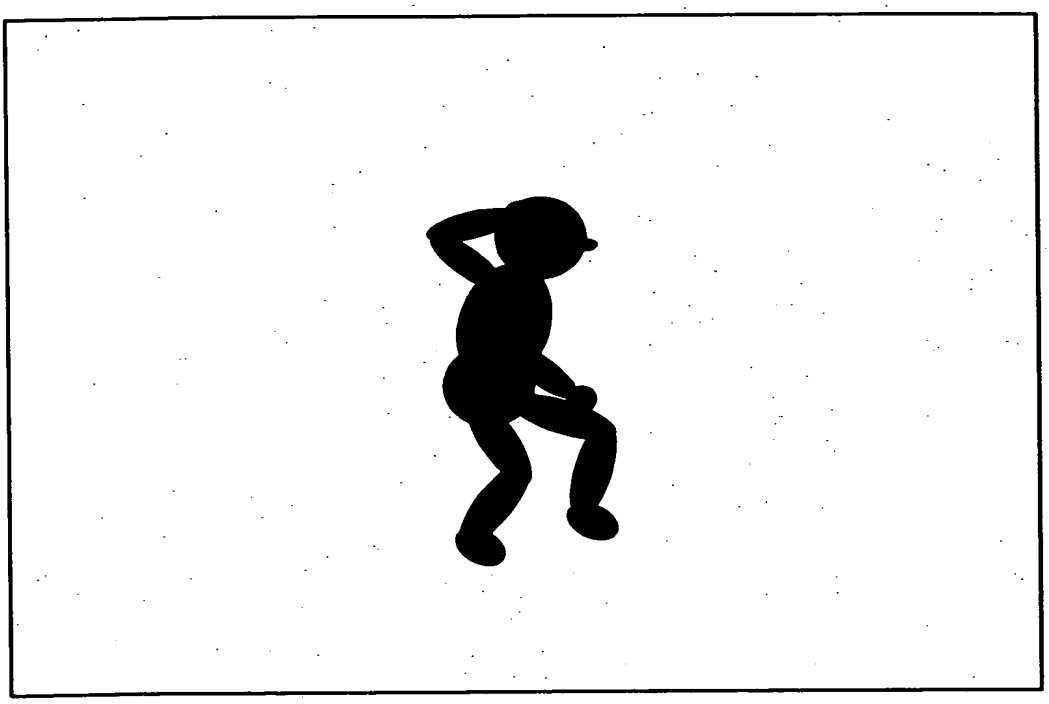


FIG. 3B DEFOCUSED IMAGE

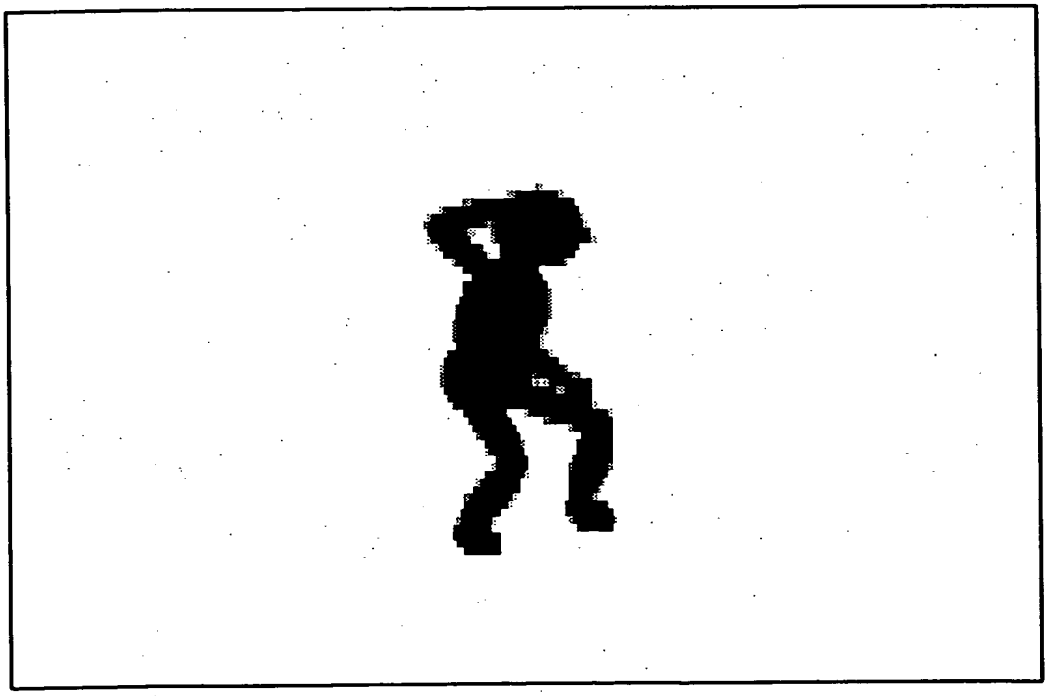


FIG. 4A

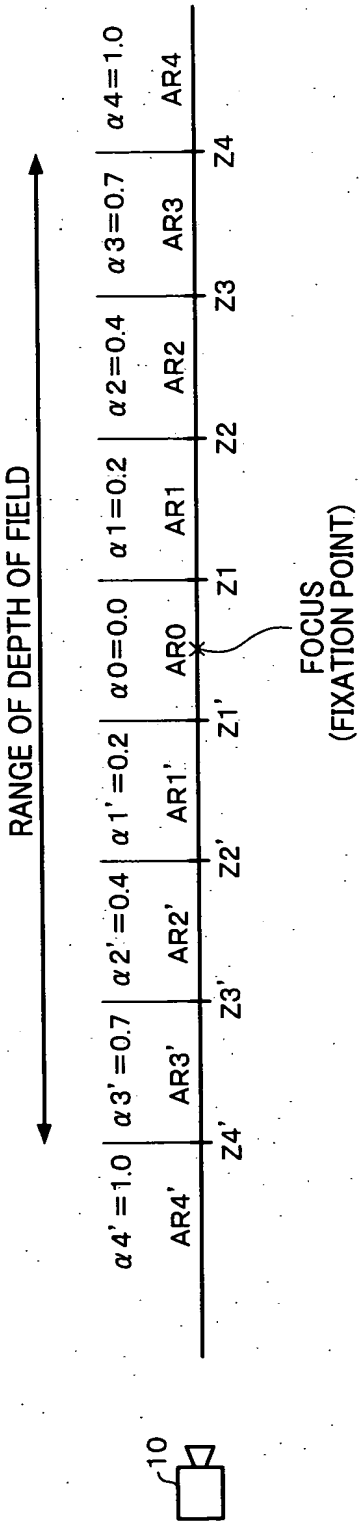

RANGE OF DEPTH OF FIELD
α4'=1.0
AR4'
α3'=0.7
AR3'
α2'=0.4
AR2'
α1'=0.2
AR1'
α0=0.0
AR0
α1=0.2
AR1
α2=0.4
AR2
α3=0.7
AR3
α4=1.0
AR4
Z4'
Z3'
Z2'
Z1'
Z1
Z2
Z3
Z4
FOCUS
(FIXATION POINT)
10

FIG. 4B

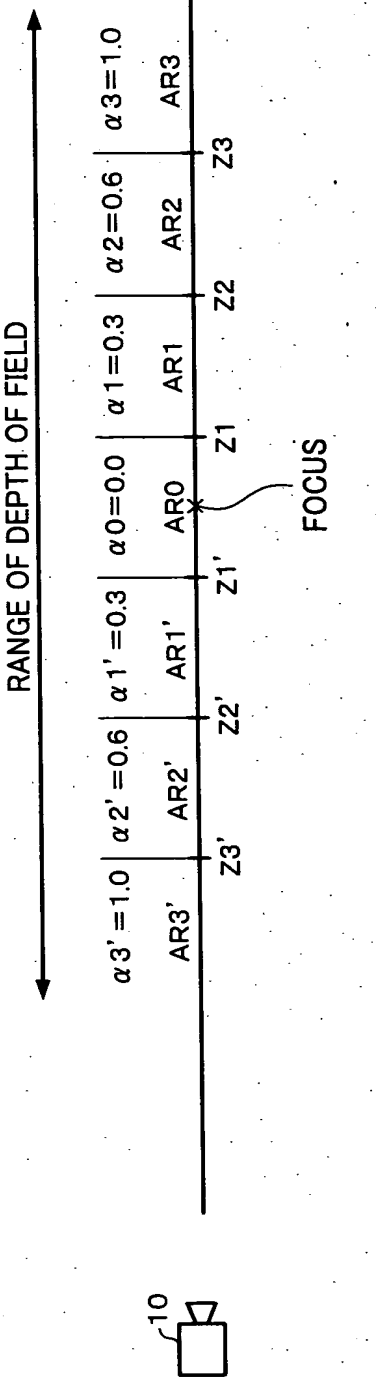

RANGE OF DEPTH OF FIELD
α3'=1.0
AR3'
α2'=0.6
AR2'
α1'=0.3
AR1'
α0=0.0
AR0
α1=0.3
AR1
α2=0.6
AR2
α3=1.0
AR3
Z3'
Z2'
Z1'
Z1
Z2
Z3
FOCUS
10

FIG. 5A

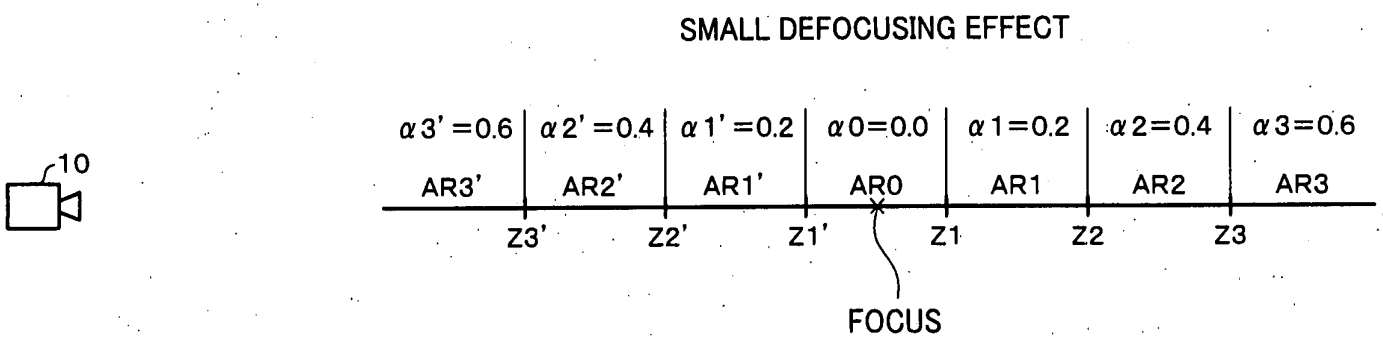

SMALL DEFOCUSING EFFECT
10
α3'=0.6
α2'=0.4
α1'=0.2
α0=0.0
α1=0.2
α2=0.4
α3=0.6
AR3'
AR2'
AR1'
AR0
AR1
AR2
AR3
Z3'
Z2'
Z1'
Z1
Z2
Z3
FOCUS

FIG. 5B

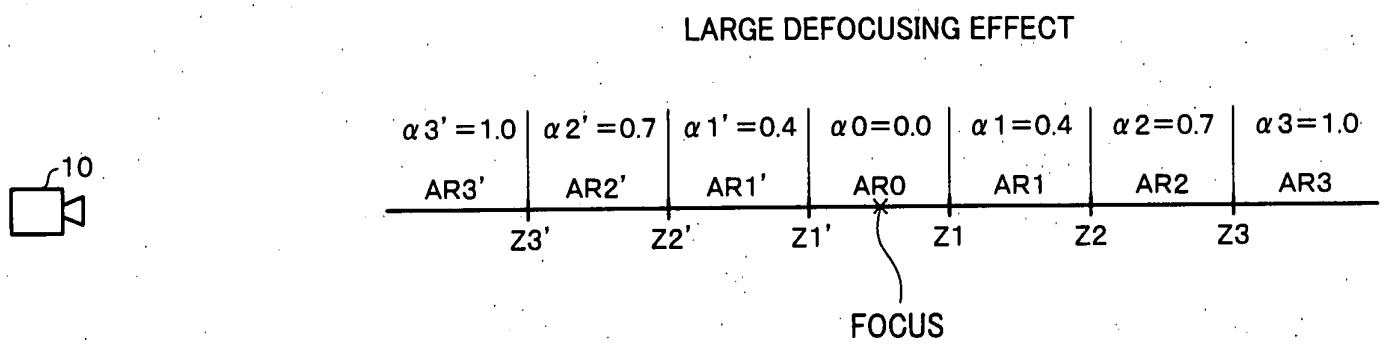

LARGE DEFOCUSING EFFECT
10
α3'=1.0
α2'=0.7
α1'=0.4
α0=0.0
α1=0.4
α2=0.7
α3=1.0
AR3'
AR2'
AR1'
AR0
AR1
AR2
AR3
Z3'
Z2'
Z1'
Z1
Z2
Z3
FOCUS

FIG. 6A

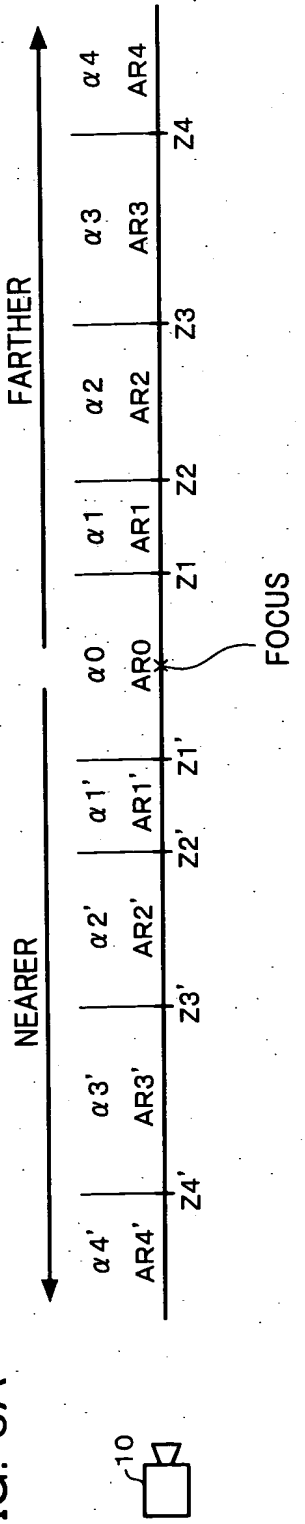


FIG. 6B

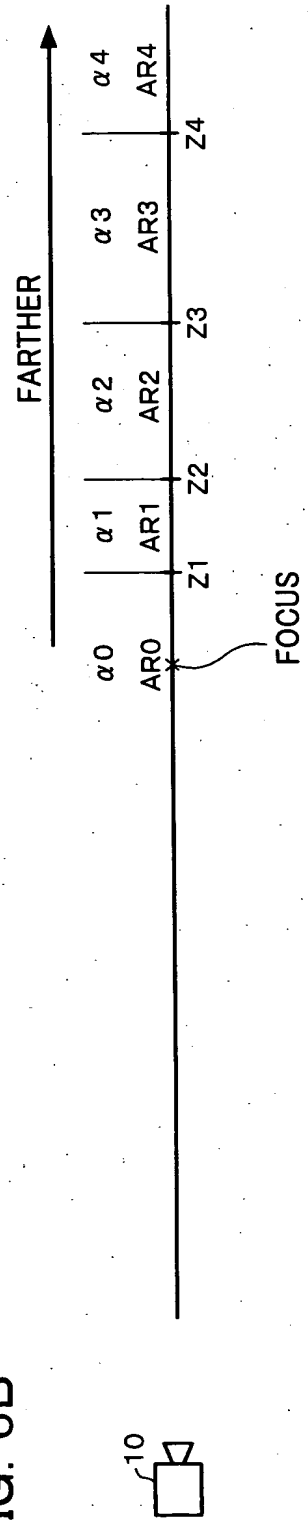
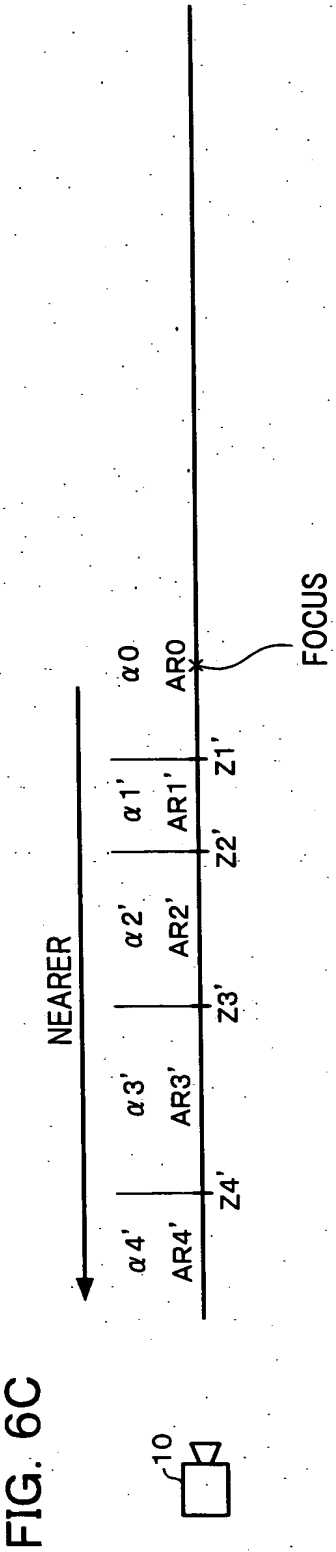


FIG. 6C



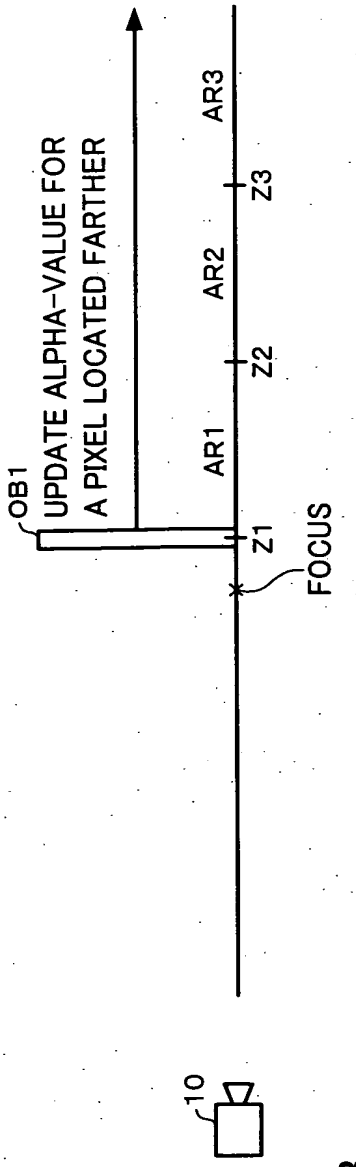


FIG. 7A

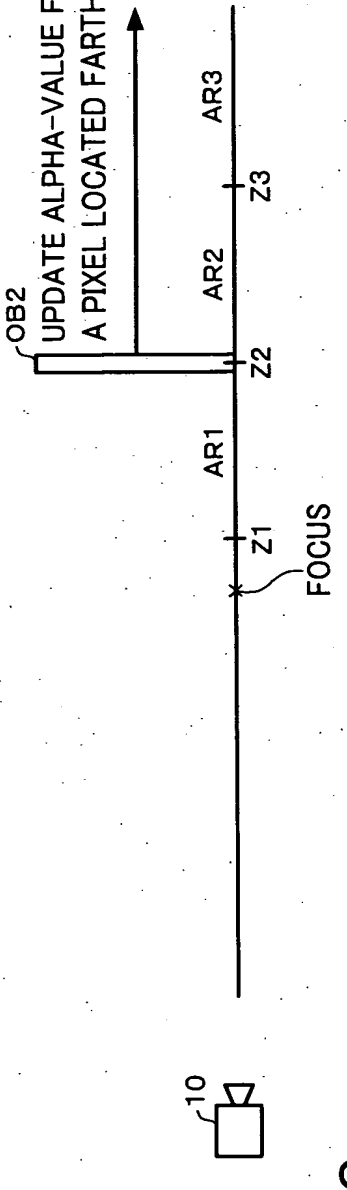


FIG. 7B

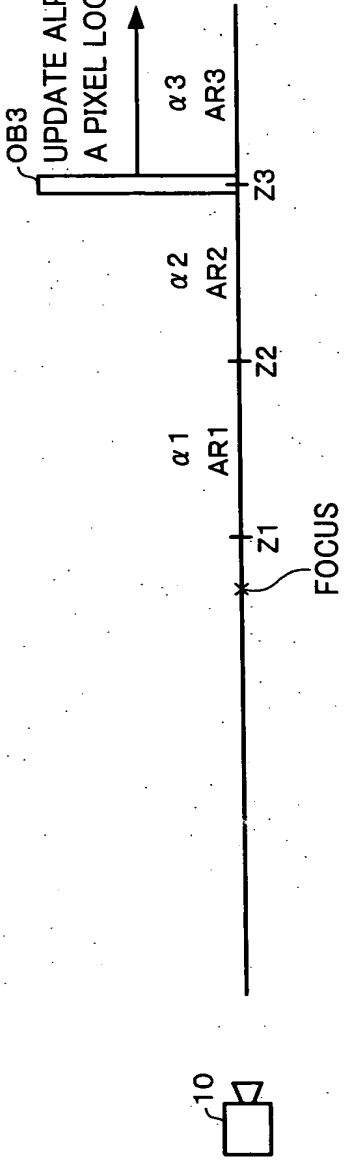


FIG. 7C

FIG. 8A

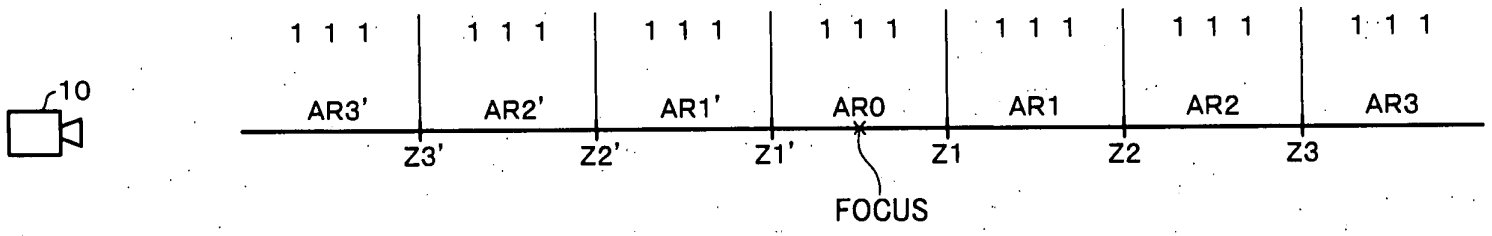


FIG. 8B

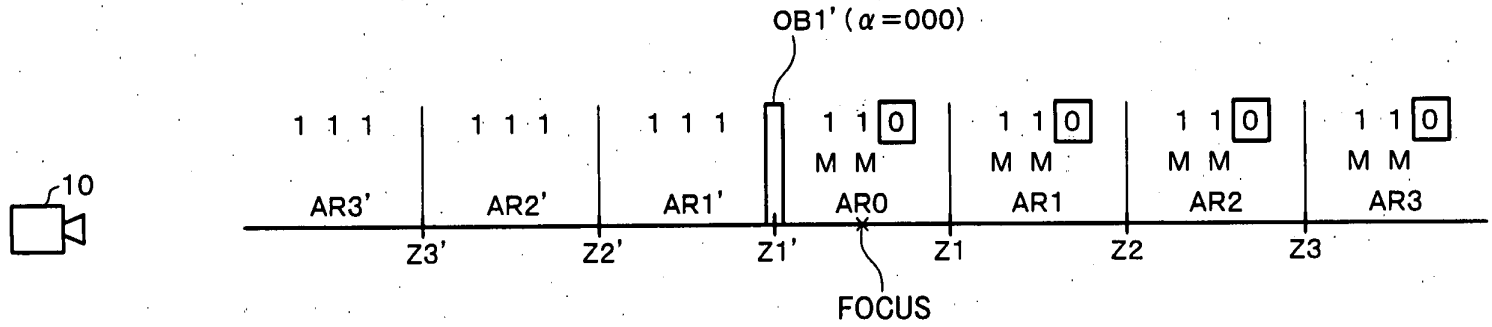


FIG. 8C

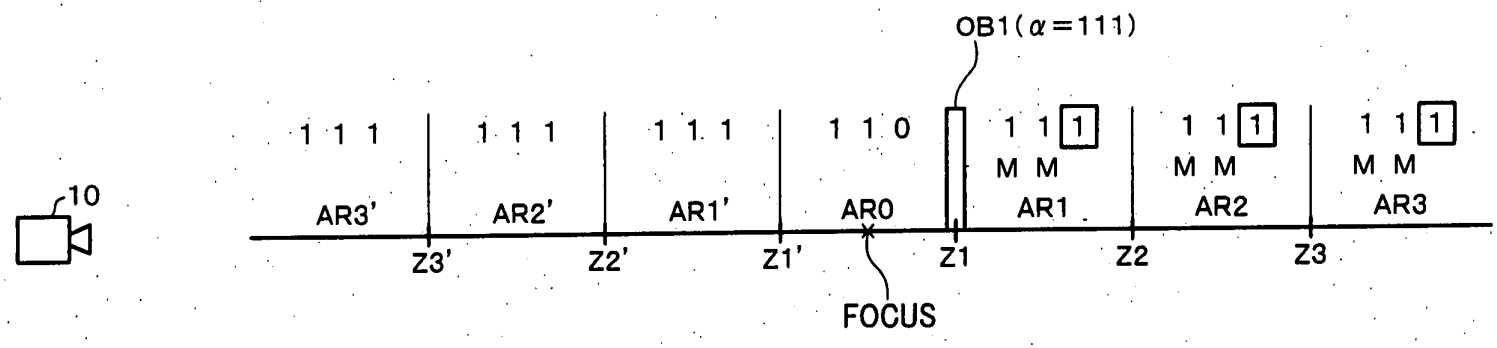


FIG. 9A

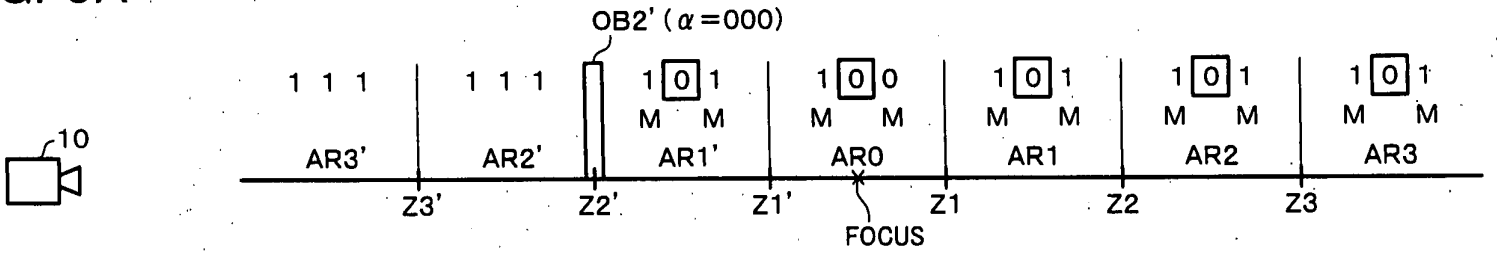


FIG. 9B

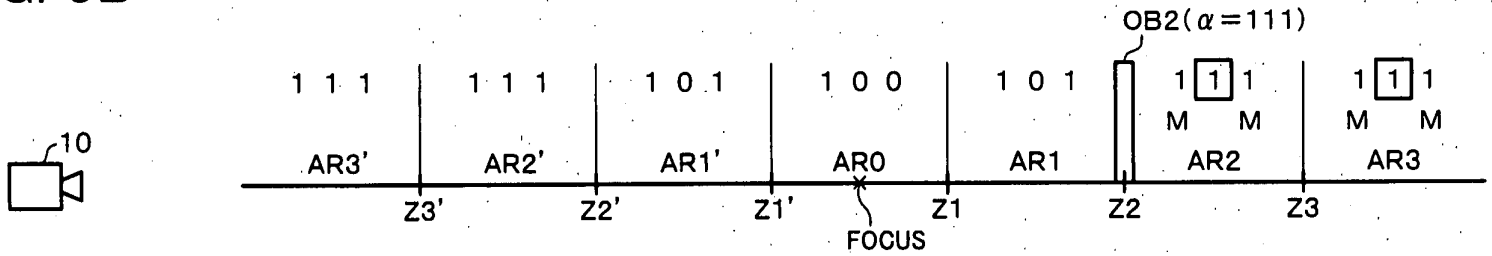


FIG. 9C

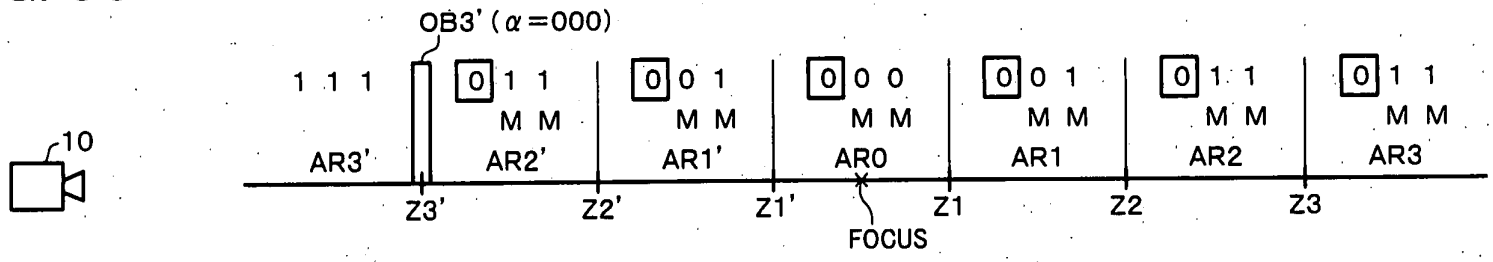


FIG. 9D

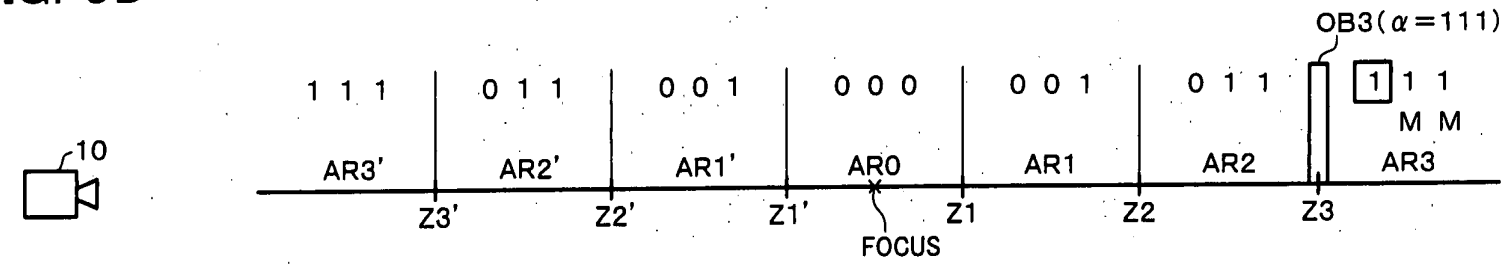


FIG. 10

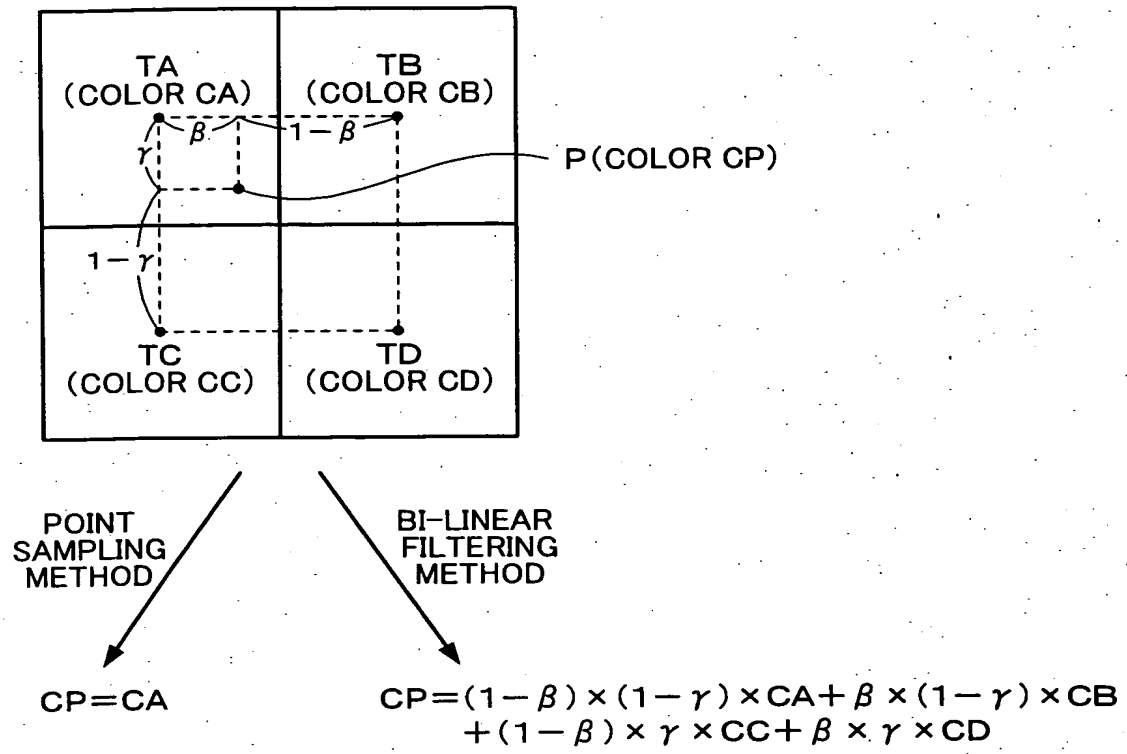

TA
(COLOR CA)
TB
(COLOR CB)
β
1−β
γ
P(COLOR CP)
1−γ
TC
(COLOR CC)
TD
(COLOR CD)
POINT SAMPLING METHOD
BI-LINEAR FILTERING METHOD
CP=CA
CP=(1−β)×(1−γ)×CA+β×(1−γ)×CB
+(1−β)×γ×CC+β×γ×CD

FIG. 11

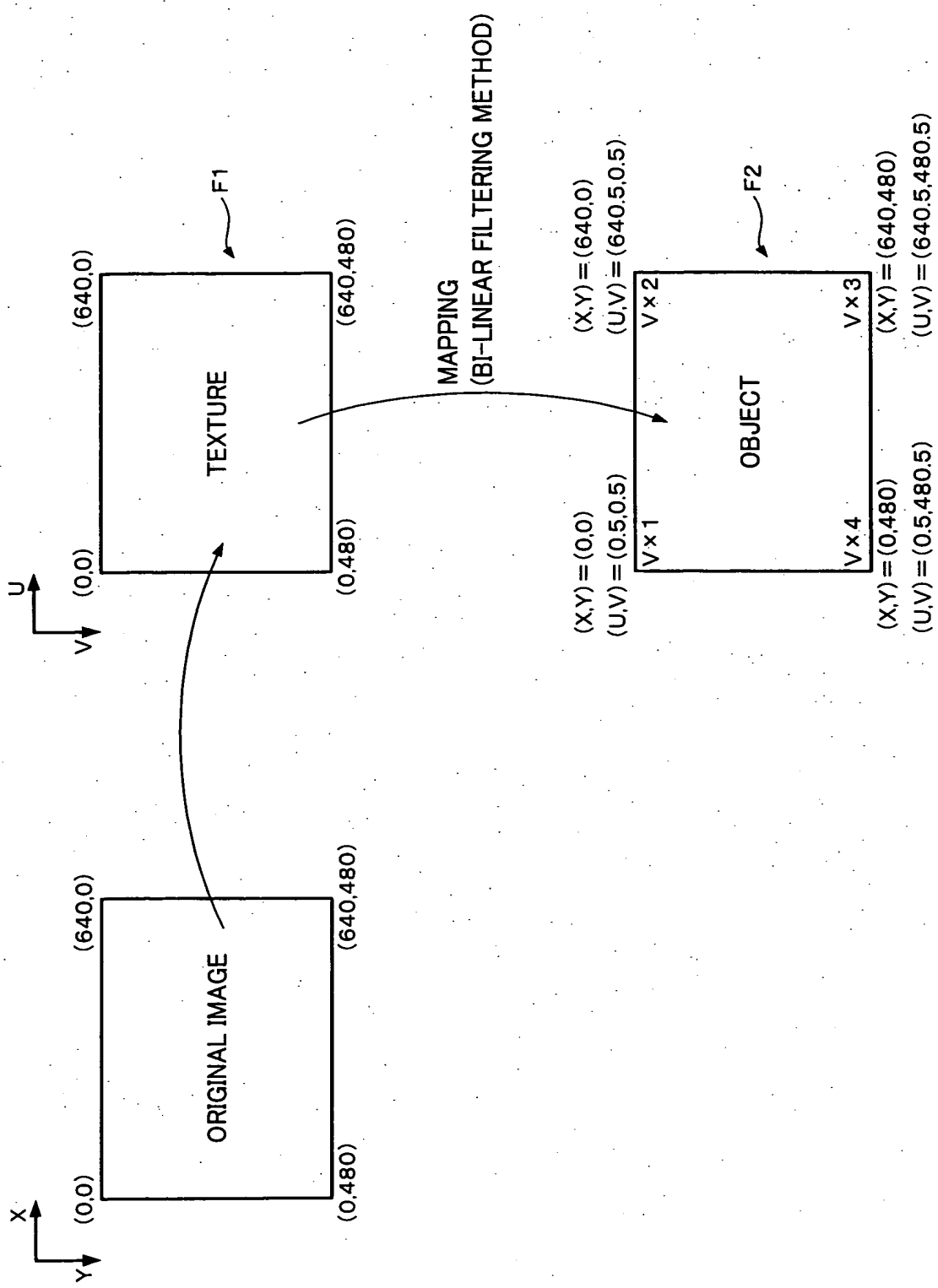

ORIGINAL IMAGE
(0,0)
(640,0)
(0,480)
(640,480)
X
Y
TEXTURE
F1
(0,0)
(640,0)
(0,480)
(640,480)
U
V
MAPPING
(BI-LINEAR FILTERING METHOD)
OBJECT
F2
V×1
V×2
V×3
V×4
(X,Y)=(0,0)
(U,V)=(0.5,0.5)
(X,Y)=(640,0)
(U,V)=(640.5,0.5)
(X,Y)=(0,480)
(U,V)=(0.5,480.5)
(X,Y)=(640,480)
(U,V)=(640.5,480.5)

FIG. 12

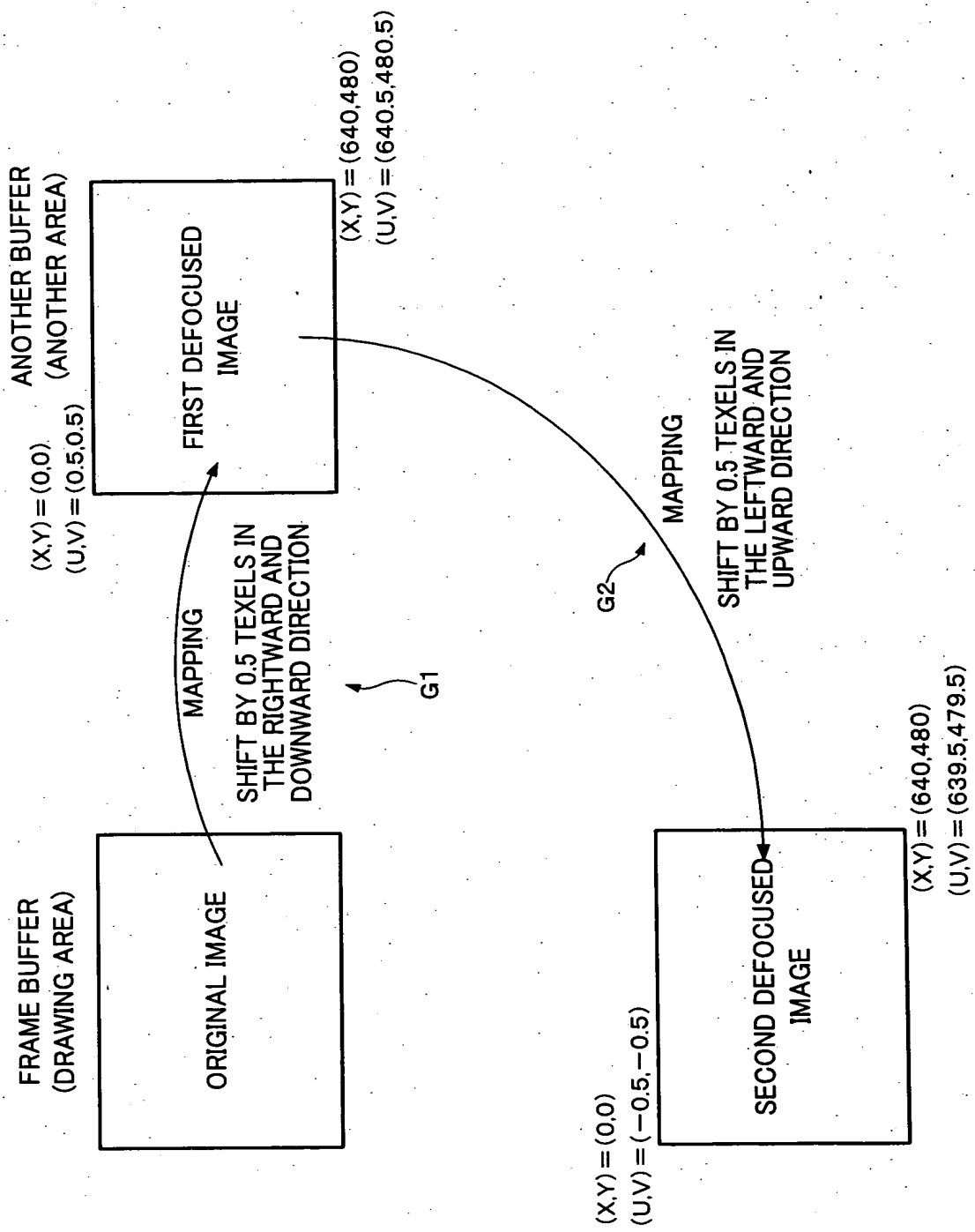

FRAME BUFFER
(DRAWING AREA)
ORIGINAL IMAGE
(X,Y)=(0,0)
(U,V)=(0.5,0.5)
ANOTHER BUFFER
(ANOTHER AREA)
FIRST DEFOCUSED
IMAGE
(X,Y)=(640,480)
(U,V)=(640.5,480.5)
MAPPING
SHIFT BY 0.5 TEXELS IN
THE RIGHTWARD AND
DOWNWARD DIRECTION
G1
G2
MAPPING
SHIFT BY 0.5 TEXELS IN
THE LEFTWARD AND
UPWARD DIRECTION
(X,Y)=(0,0)
(U,V)=(−0.5,−0.5)
SECOND DEFOCUSED
IMAGE
(X,Y)=(640,480)
(U,V)=(639.5,479.5)

FIG. 13A

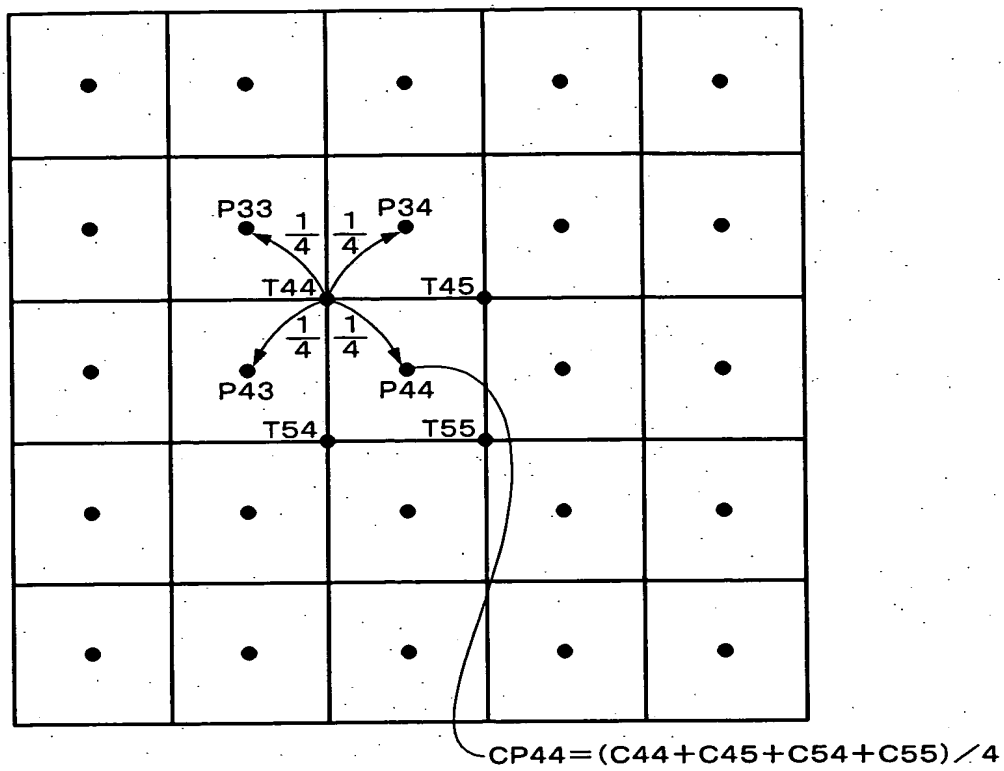


FIG. 13B

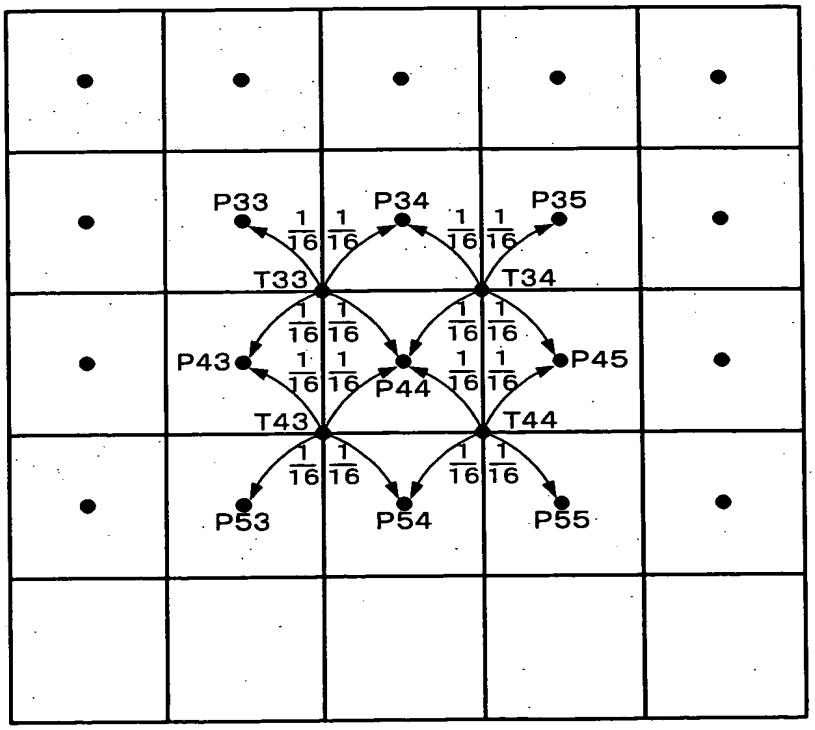


FIG. 14A

	$\frac{1}{16}$	$\frac{2}{16}$	$\frac{1}{16}$	
	$\frac{2}{16}$	$\frac{4}{16}$	$\frac{2}{16}$	
	$\frac{1}{16}$	$\frac{2}{16}$	$\frac{1}{16}$	

FIG. 14B

$\frac{1}{256}$	$\frac{4}{256}$	$\frac{6}{256}$	$\frac{4}{256}$	$\frac{1}{256}$
$\frac{4}{256}$	$\frac{16}{256}$	$\frac{24}{256}$	$\frac{16}{256}$	$\frac{4}{256}$
$\frac{6}{256}$	$\frac{24}{256}$	$\frac{36}{256}$	$\frac{24}{256}$	$\frac{6}{256}$
$\frac{4}{256}$	$\frac{16}{256}$	$\frac{24}{256}$	$\frac{16}{256}$	$\frac{4}{256}$
$\frac{1}{256}$	$\frac{4}{256}$	$\frac{6}{256}$	$\frac{4}{256}$	$\frac{1}{256}$

FIG. 15

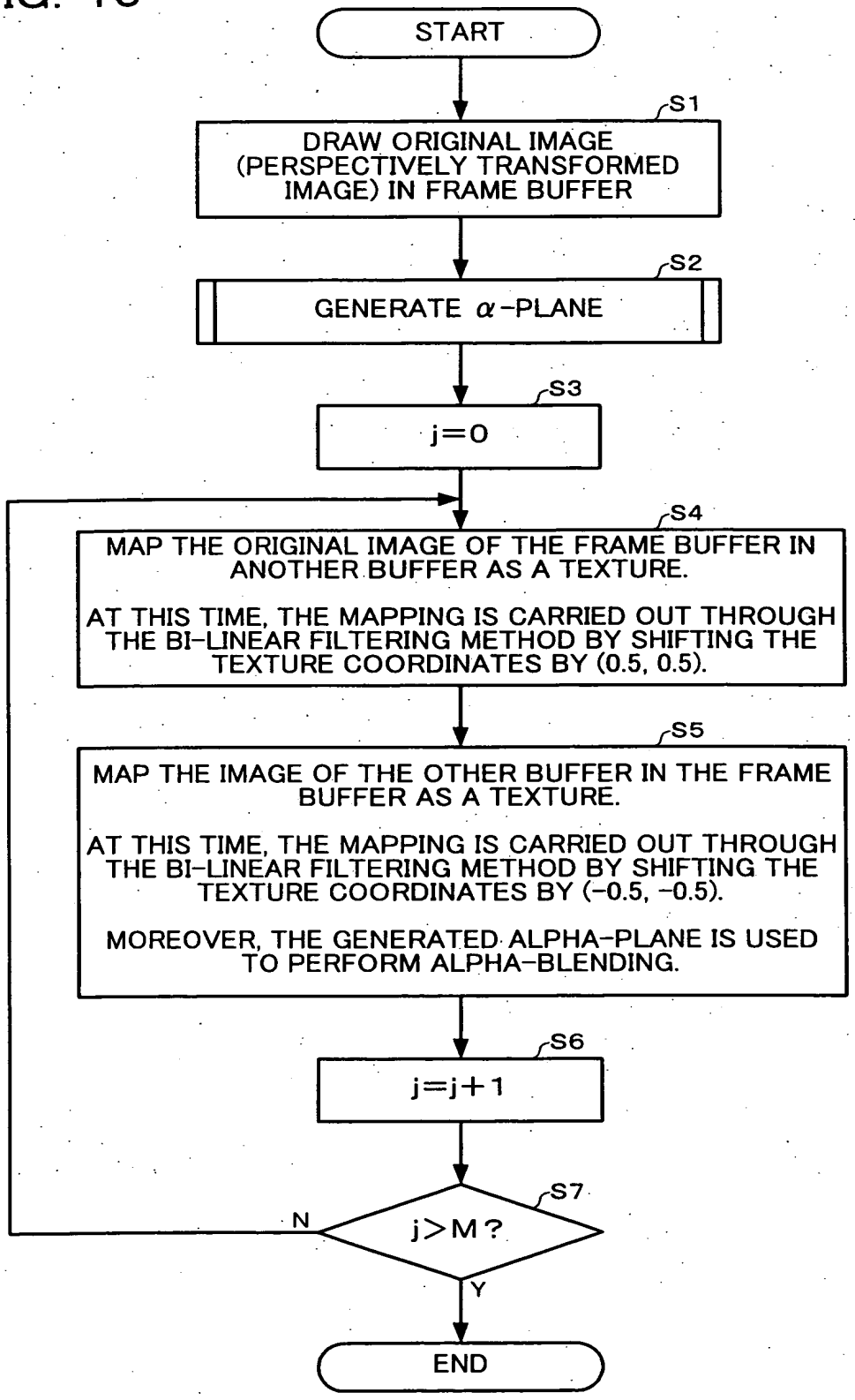

START
S1
DRAW ORIGINAL IMAGE (PERSPECTIVELY TRANSFORMED IMAGE) IN FRAME BUFFER
S2
GENERATE α-PLANE
S3
j=0
S4
MAP THE ORIGINAL IMAGE OF THE FRAME BUFFER IN ANOTHER BUFFER AS A TEXTURE.
AT THIS TIME, THE MAPPING IS CARRIED OUT THROUGH THE BI-LINEAR FILTERING METHOD BY SHIFTING THE TEXTURE COORDINATES BY (0.5, 0.5).
S5
MAP THE IMAGE OF THE OTHER BUFFER IN THE FRAME BUFFER AS A TEXTURE.
AT THIS TIME, THE MAPPING IS CARRIED OUT THROUGH THE BI-LINEAR FILTERING METHOD BY SHIFTING THE TEXTURE COORDINATES BY (−0.5, −0.5).
MOREOVER, THE GENERATED ALPHA-PLANE IS USED TO PERFORM ALPHA-BLENDING.
S6
j=j+1
S7
j>M?
N
Y
END

FIG. 16

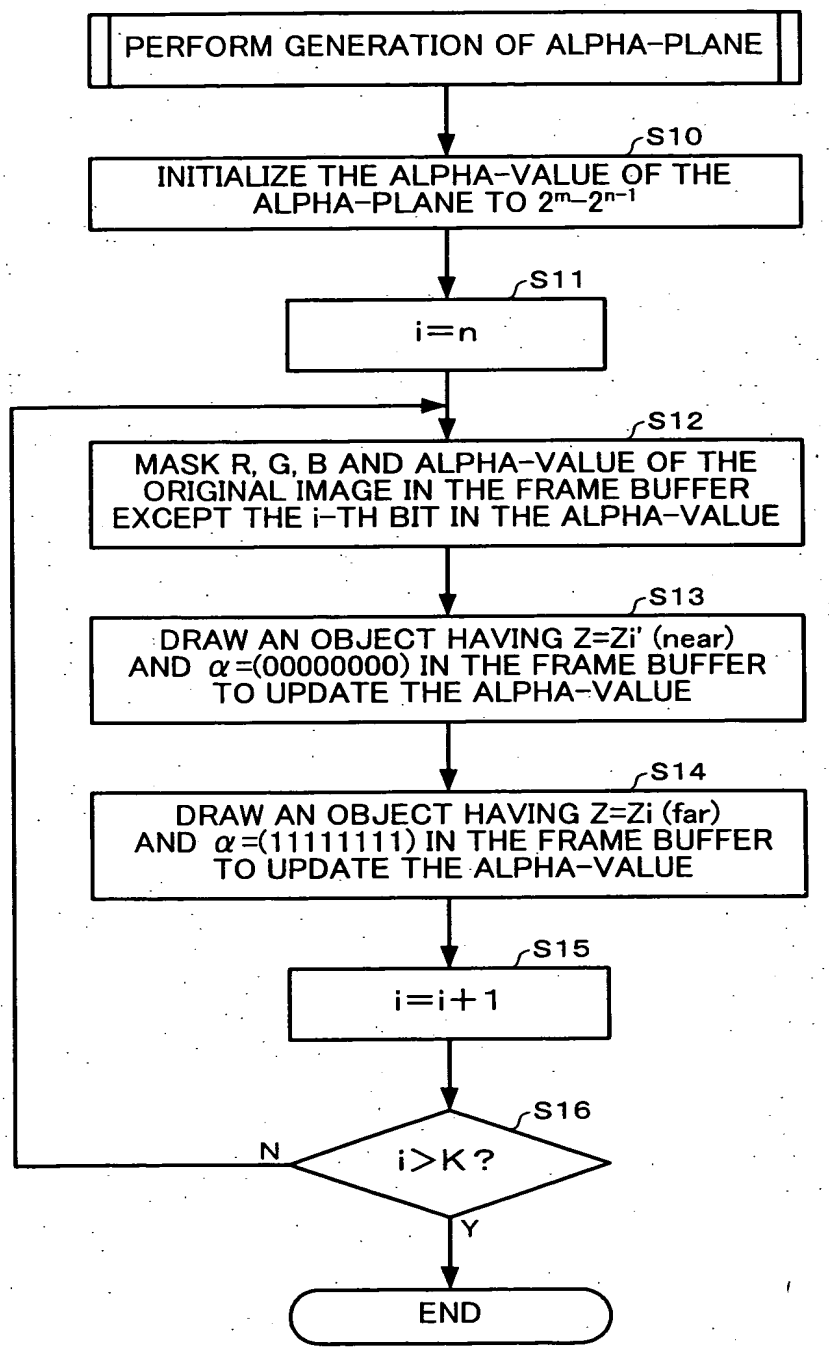

PERFORM GENERATION OF ALPHA-PLANE
S10
INITIALIZE THE ALPHA-VALUE OF THE ALPHA-PLANE TO 2^m-2^{n-1}
S11
i=n
S12
MASK R, G, B AND ALPHA-VALUE OF THE ORIGINAL IMAGE IN THE FRAME BUFFER EXCEPT THE i-TH BIT IN THE ALPHA-VALUE
S13
DRAW AN OBJECT HAVING Z=Zi' (near) AND α=(00000000) IN THE FRAME BUFFER TO UPDATE THE ALPHA-VALUE
S14
DRAW AN OBJECT HAVING Z=Zi (far) AND α=(11111111) IN THE FRAME BUFFER TO UPDATE THE ALPHA-VALUE
S15
i=i+1
S16
i>K?
N
Y
END

FIG. 17

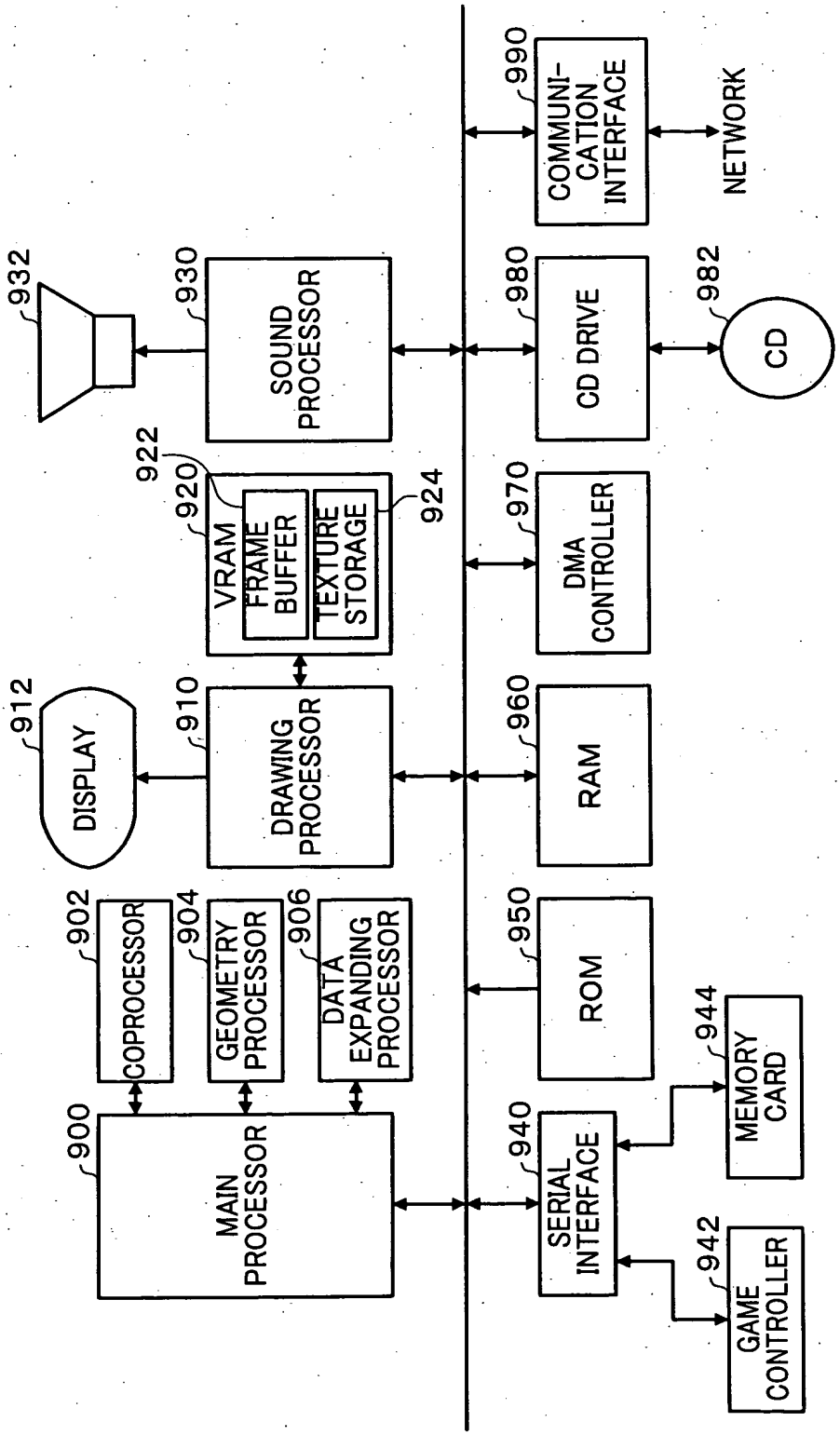

MAIN PROCESSOR
900
COPROCESSOR
902
GEOMETRY PROCESSOR
904
DATA EXPANDING PROCESSOR
906
DRAWING PROCESSOR
910
DISPLAY
912
VRAM
920
FRAME BUFFER
922
TEXTURE STORAGE
924
SOUND PROCESSOR
930
932
ROM
950
RAM
960
DMA CONTROLLER
970
SERIAL INTERFACE
940
GAME CONTROLLER
942
MEMORY CARD
944
CD DRIVE
980
CD
982
COMMUNI-CATION INTERFACE
990
NETWORK

FIG. 18A

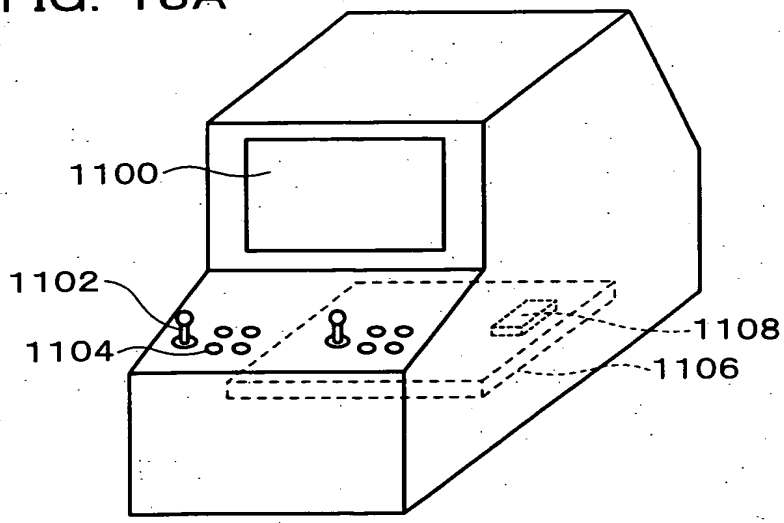


FIG. 18B

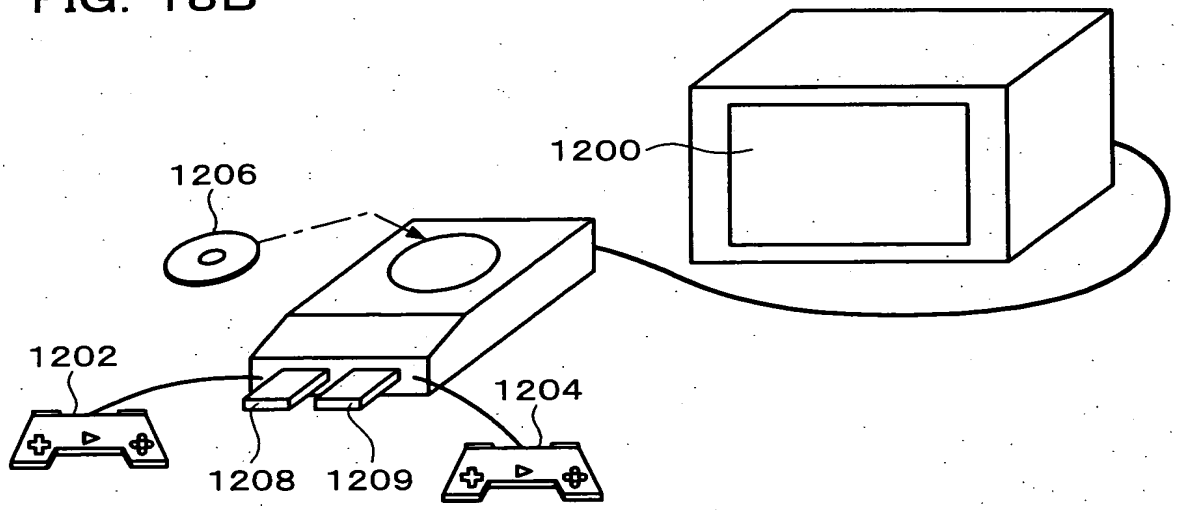
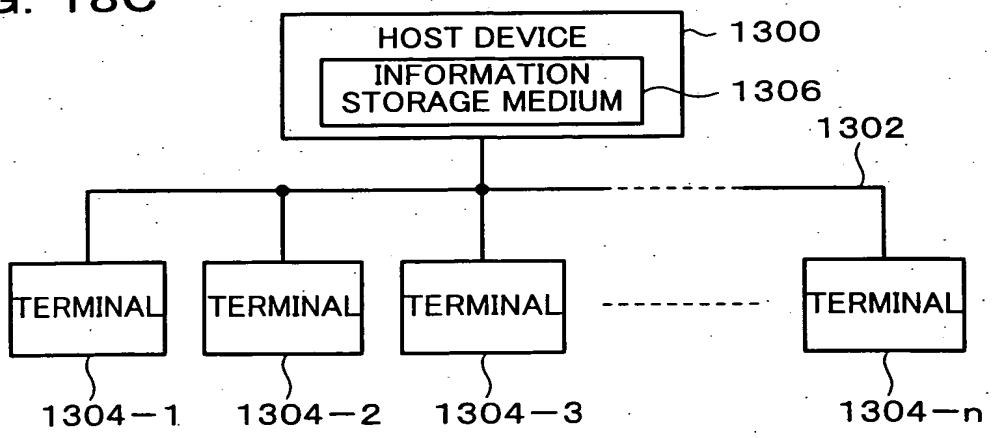



FIG. 18C